BUILDING REGULATIONS up to 98% Seasonal efficiency (gross) PART L COMPLIANT

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Authorised User No. 00510

Hamworthy Dorchester DR-FC Evo

Condensing, Room Sealed and Open Flue
Direct Gas Fired Storage Water Heaters
30kW to 120kW Natural Gas or LPG
Continuous outputs 600l/h to 2400l/h

CE

Hamworthy

Heating *at work.*

Dorchester DR-FC Evo

Condensing Direct Gas Fired Storage Water Heaters

Hamworthy offer the Dorchester DR-FC Evo range of condensing direct gas fired water heaters in response to the demand for increased efficiencies in domestic hot water (DHW) appliances for modern commercial applications.

Featuring modulating burners and condensing operation, the Dorchester DR-FC Evo water heaters provide a high efficiency DHW solution which can be sized to suit many applications; and with a wide range of flueing options supported: room sealed, open flue, flue schemes B23, C13, C33 and C53, and very long flue runs up to 100m, these water heaters can be sited almost anywhere in a building.

There are 7 models in the Dorchester DR-FC Evo range from 600 to 2400 litres/hour continuous output at 44°C temperature rise, and storage capacities from 227 to 504 litres. For large loads, multiple water heaters can be installed, and for a large hot water buffer, Hamworthy can offer a direct fired unit with additional storage tanks.

The Dorchester DR-FC Evo can be set for continuous operation or set to follow its versatile 21-period/week programmable timer–with extra period temporary override. Service programs and an independent programmable anti-legionella cycle function are also available.

Timer control allows target storage temperatures to be set individually for each programmed water heater ON period so that the water heater operation can be closely aligned to the predicted weekly demand cycle, and optimised for performance or efficiency priorities at different times as required.

An intuitive control panel and backlit display provides the user interface to the water heater's comprehensive controls. Operating status, history, diagnostics, service due etc. can be displayed at the control panel or remotely via the optional remote monitoring unit.

Options

- **Natural gas or LPG**
- **Unvented supply kit**
- **Horizontal or vertical flue terminal kit**
- **Top to bottom pump recirculation kit**
- **Remote monitoring unit**

BENEFITS

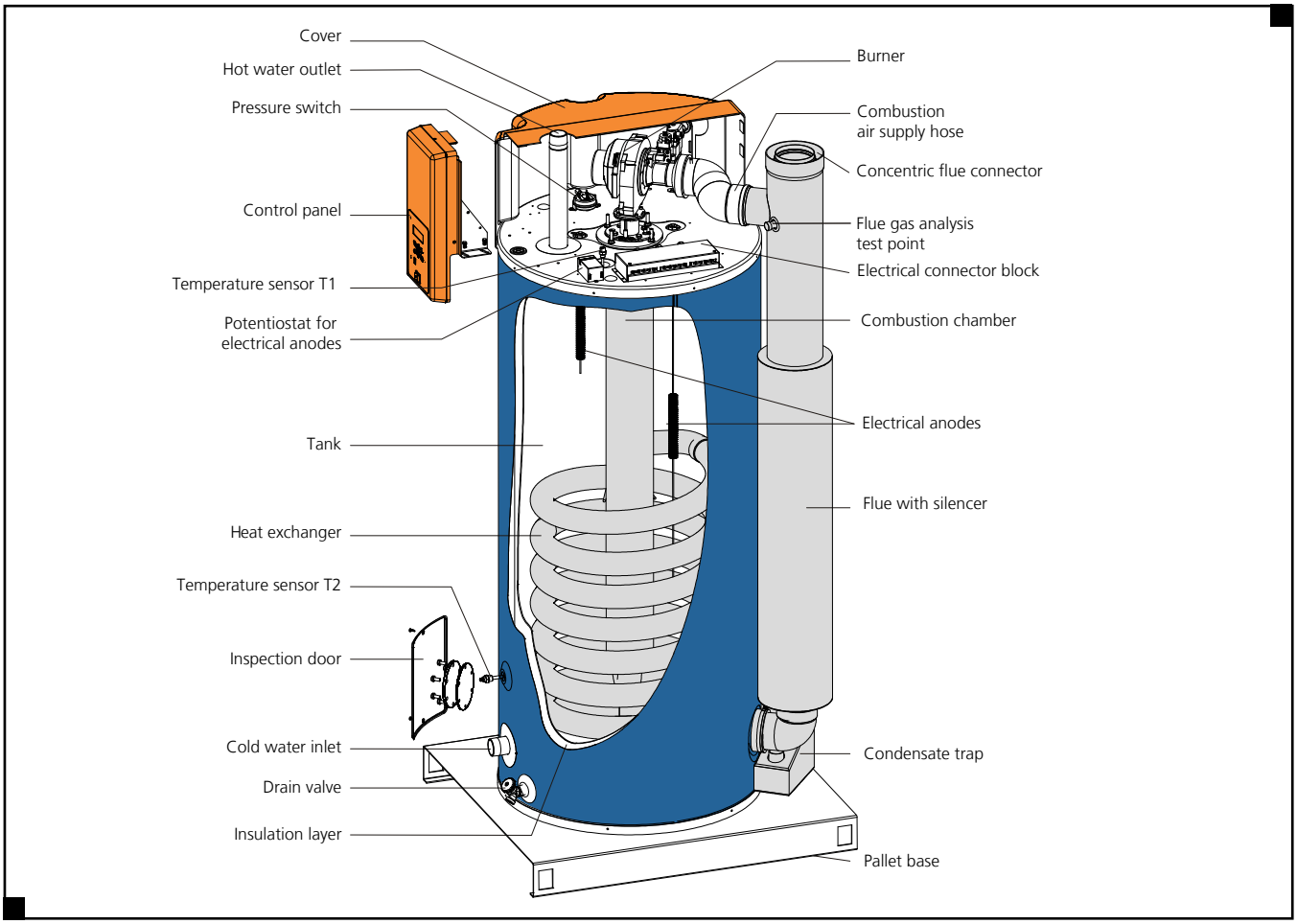
- **Multiple temperature settings to enhance condensing performance**
- **Exceeds Part L minimum requirements**
- **Electrical anode for corrosion protection**
- **Whisper quiet**
- **Low NOx**
- **Up to 98% seasonal efficiency**

Using different hot water temperature settings during peak load and off peak periods can enhance energy saving condensing performance

Typical plant room with Dorchester DR-FC Evo condensing water heater and Purewell VariHeat boilers

Typical Layout

Dorchester DR-FC Evo

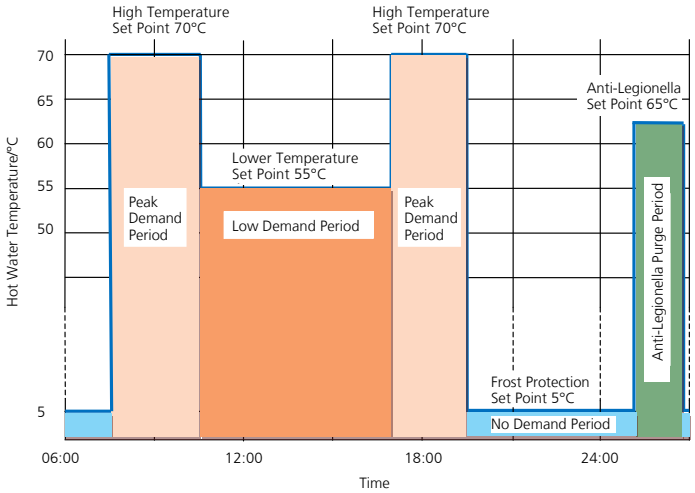


Flexible Programmable Timer Controls

The Dorchester DR-FC Evo timer control features 21 programmable ON-OFF periods (3 periods per day/ 7 days per week), with an individual programmable thermostat set point per ON period. This allows efficient hot water schemes to be planned to suit the specific application, taking into account the required maximum draw-off at different times of the day, storage temperature safety philosophy and temperature required for maximum condensing operation.

In this example (see graph) the storage temperature is set to 70°C during the two peak demand periods and at 55°C during the low demand period. In periods of no demand the water heater is set OFF. Frost protection is set at 5°C which will switch on the water heater, overriding the OFF period until the store temperature reaches 20°C to prevent water freezing. The anti-legionella cycle is programmed to run at night, once per week, heating the water to 65°C for at least 1 hour.

In the peak periods, setting to 70°C ensures demand can be met, both while the water heater is switched on and for an extended time after switching off, by using automatic mixing valves to mix with cold water at the taps down to the required temperature. During the low demand period, the set point is set to 55°C to prolong condensing operation of the water heater while still satisfying the maximum demand throughout the period.



Specification

Dorchester DR-FC Evo

The Hamworthy Dorchester DR-FC Evo range of direct fired storage water heaters provide plenty of choice in meeting hot water demands for a wide variety of commercial applications.

With currently eight ranges in the Dorchester family comprising over 30 models, the DR-FC Evo range represents the latest in proven high efficiency condensing technology to maximise the energy performance and far exceed the minimum efficiency requirements of the Building Regulations, Part L.

The Dorchester DR-FC Evo range of water heaters are manufactured to the highest standards using the latest production technology to ensure a high quality long lasting finish in every product configuration. Compliance is assured with stringent controls in accordance with the European Standards and each model carrying the CE mark for compliance with the European standard BS EN 89:2000.

Construction

The water heater cylinders are constructed from high grade steel and coated with a high quality vitreous enamel lining. The fabrication of the cylinder and welding is completed fully before the glass lining is applied, ensuring that the integrity of the lining is not affected during manufacture. On completion of the fabrication, the cylinder undergoes a precise glass coating process where the unit is rotated in every direction to ensure an even glaze is applied throughout. Surplus material is drained before the unit is baked at 840°C to complete the adhesion of the lining to all internal surfaces of the cylinder, providing a long lasting finish. The cylinder is covered with a 50mm layer of CFC free foam insulation to ensure that standing losses are kept to a minimum.

Burner

The modulating pre-mix burner is mounted on top of the heater in a down firing arrangement. The controlled supply of gas and air achieves the optimum gas/air mixture for efficient performance and clean combustion. The burner can modulate down to 40% of full power.

Heat Exchanger

The hot combustion gases are directed down through the combustion chamber which extends to near the base of the tank then rises up the heat exchanger to a point where it forms a spiral which descends again, exiting at the flue connection near the base. This arrangement maximises heat transfer, as gases cooled by colder water lower down the tank start to condense. This condensation causes latent heat energy to be transferred to the cooler water, increasing the performance of the unit. Condensation formed in this process is discharged via a condensate trap. This design of the heat exchanger eliminates the problems traditionally associated with scale as any build-up will fall away to the base of the unit, and not affect heat transfer or create hot spots.

Condensing Effect

In the heat exchanger process, as the flue gases become cooler they pass into the lower layer of the tank where the cold water inlet tops up the supply of water. This maximises the opportunity to condense, releasing the latent energy in the process. The condensate in the flue gases is discharged via the condensate trap at the base of the unit.

Anode Protection

All models are fitted with electrical anodic corrosion protection as standard, ensuring excellent protection from corrosion, and being fully effective even with water supplies that have conductivity as low as 125 micro-siemens. Non-sacrificial anodes are used and these require no routine maintenance or replacement.

It is essential that the electrical anode protection system power is maintained i.e. the water heater must have a permanent supply. Any external time controls must use the remote enable connections and not interrupt the mains supply to the water heater. An uninterruptable power supply is recommended to ensure proper protection of the unit is maintained.

Clean Out Door

The Dorchester DR-FC Evo models have an easily accessible clean out door that allows for the inspection and cleaning of the tank's interior, as required by the recommendations of the HSC for the control of Legionellosis, including Legionnaires' disease.

LPG Fuels

All Dorchester water heaters are suitable for LPG fuel. The fuel type must be specified at the time of ordering. It is strongly recommended that on LPG installations, gas detection equipment is fitted and that this equipment is positioned near the heater and at low level. It is also imperative that the plant room is ventilated at high and low level. The LPG variants of the Dorchester DR FC Evo must not be installed in basement plant rooms.

Flue Connection

The flues gases exit the cylinder at the base of the unit and return to the top for connection into an adaptor to combine the incoming combustion air and discharging flue gases into a concentric connection.

Flue System

The Dorchester DR-FC Evo water heaters are suitable for open flue or room sealed applications. Room sealed flues can be discharged through horizontal or vertical concentric terminals. Twin duct systems are available for longer flue runs, up to 100m. Shorter runs can use concentric ducts up to 40m. Flue schemes B23, C13, C33 and C53 are supported. *Please refer to the flue section (from page 20) for further details of flue systems.*

Specification

Dorchester DR-FC Evo

Open Vented or Unvented Systems

The water heaters are suitable for open vented water systems i.e. those fed typically via a header tank and float valve arrangement. They may also be used in unvented water systems fed directly from the mains cold water supply if an optional unvented water supply kit is used.

Unvented Water Supply Kit Option

The optional unvented supply kit is essential for any unvented application and includes an expansion vessel sized for the water heater and local pipework only.

Unvented water supply kit option

For large hot water systems or systems with additional storage tanks, additional expansion vessel capacity may be required.

The unvented supply kit allows the water heater to be fed directly from the mains water supply or boosted cold water supply, without the need for header tanks.

Each unvented supply kit is designed to be used with an individual water heater. Multiple water heater installations should be provided with one unvented supply kit per water heater.

The kit contains all the essential components to comply with the Water Supply (water fittings) Regulations 1999, including a suitably sized pressure and temperature relief valve, which locates directly into the water heater.

Each unvented supply kit is sized 1" and comprises the following items:

- Strainer
- Adjustable pressure reducing valve with tapping points for inlet and outlet pressure measurement
- Non return valve
- ¾" Expansion relief valve, 6 bar
- Temperature and pressure relief valve, 7 bar, 95°C
- 24 litre expansion vessel, 3.5 bar cushion pressure.

Designed for Safety

The Health and Safety Commission (HSC) approved code practice and guidance document L8, makes it clear that if the risk of Legionella is to be minimised, then the recommendations must be observed in so far as they relate to hot & cold water systems. Dorchester water heaters conform to these requirements as follows:

- Good access for cleaning
- Generous flow and return connections
- Adequately sized drain
- Base designed to avoid sludge traps
- Anodes to reduce metal corrosion
- Number of tappings correctly positioned to facilitate recirculation, destratification and to obviate stagnation
- Designed to meet unvented supply requirements.

Controlling Legionella

All Dorchester models are designed to meet the Health & Safety Commission (HSC) requirements for safe production of hot water, and in particular the control of Legionellosis.

Legionella bacteria are common in natural water sources and therefore low concentrations may be present in many water systems. It is important that hot water services are designed and operated in such a way that these organisms are prevented from multiplying.

Water temperature is a significant factor in controlling the risk, with optimum conditions for bacterial growth occurring between 20°C and 45°C.

Regular cleaning of the system will help to avoid the build-up of sediments, which may harbour or provide nutrients for the bacteria.

Water stagnation may encourage the growth of biofilm, which can provide local conditions that may promote the proliferation of Legionella bacteria.

Anti-Legionella Controls Function

The Dorchester DR-FC Evo controls incorporate a specific anti-legionella safety function which can be set to perform a weekly anti-legionella purge cycle, running the water heater for a period at a high temperature (default 65°C for one hour) to prevent the risk of legionella bacteria forming in the vessel.

This can be set to run automatically during periods when hot water will not be used, for example to minimise the risk of scalding. It can also be set to run the system recirculation pump and/or the optional top to bottom recirculation kit pump concurrently with the legionella purge cycle to ensure that the whole system is purged.

Controls

Dorchester DR-FC Evo

The Dorchester DR-FC Evo range features advanced control capability through a digital control panel and backlit display with adjustable contrast, display illumination time and scroll speed. Programming the settings is achieved via the neat and easy to use control panel. The display shows time and day, actual water temperature, programmed water temperature and next switching time, on or off. It can also display operating history, service diagnostics and alert to service due, based on operating hours.

Controller features include:

- 7-day timer control mode
- Hysteresis control
- Extra Period mode (override weekly program)
- Continuous ON or OFF modes
- Frost protection function
- Anti-legionella function
- Programmable external pump control
- Data logging.

Temperature Control and Protection

Electronic temperature control manages accurate flow and storage temperatures. Temperature sensors are fitted towards the top and bottom of the unit to monitor temperatures within the unit and control heating closely for optimum performance.

- Operating temperature set point range 40°C to 80°C
- Intermediate limit temperature set point 88°C with auto reset
- High limit temperature set point 93°C, requires manual reset
- Frost protection temperature set point, 5°C.

7-day Timer Control

The 7-day timer control function allows the Dorchester DR-FC Evo flexibility to be set up to operate at up to three periods per day (21 individual periods per week) and to the appropriate set temperature during those periods, in line with the applications demand cycle (refer to the example on page 3). For each individual period the following parameters are programmable: day of week, heater ON time, heater OFF time, target temperature (set point) and pump ON/OFF.

Hysteresis Control

Hysteresis controls allow the hot water heating cycle to be finely tuned. On heat rising cycle, a hysteresis setting will allow the water temperature to overshoot the set point by a programmable number of degrees before the heater switches off, and on a heat falling cycle, another hysteresis setting will allow a few degrees undershoot below the set point before switching on the heater. Hysteresis up and hysteresis down settings are programmable and are used in balancing the need to prevent cycling against the need to continually maintain precisely the set point temperature.

Extra Period Operation

In addition to the timer control's 21 programmable periods, an extra non-repeating period can be set up using the Extra Period function. This operates the water heater to a programmed required temperature for a programmed period. The extra period overrides the timer program for its duration, and then the extra period settings are cleared on expiration.

ON/OFF Operation

Each water heater can be set to ON or OFF condition whereby the timer program is disabled and the heater remains in standby mode. If set to OFF, then frost protection remains active. It is therefore important that, during maintenance periods when the water is drained, provision is made for isolating the unit electrically to ensure non operation. During ON operation, the water heater switches on if the measured water temperature is less than the programmed temperature set point, and heats continuously until the water temperature reaches the set point.

Frost Protection

Dorchester DR-FC Evo water heaters are supplied as standard with a frost protection thermostat. When the ON/OFF switch on the control panel is in the OFF position, the frost protection system will initiate firing of the burner when the stored water temperature falls below 5°C to provide protection against freezing in the cylinder.

Anti-Legionella Function

Refer to the Anti-Legionella Controls Function description on page 5.

Top-to-Bottom Recirculation Pump Kit (Optional)

In order to prevent stratification within the heater, thus creating a zone of lower temperature water that can possibly lead to the proliferation of Legionella bacteria, the optional top-to-bottom re-circulation kit should be specified. By constantly returning water from the flow back into the base of the heater, a uniform temperature is maintained. This recirculation can be timed to operate in parallel with the anti-legionella control function.

Pump Control

The optional recirculation pump or a secondary circuit pump can be controlled via the pump ON/OFF control function associated with each timer period, or via the Pump ON/OFF control in the anti-legionella function. Both functions drive ON or OFF a single program-controlled 230V power supply output. This supply can be used for the direct control of a single pump only (maximum rating 150W). If more than one pump is to be controlled at the same time by the water heater, then these should be supplied separately via contactors and controlled via the program controlled 230V power supply.

It is possible for a service engineer to set the timed pump output for permanent operation if desired.

Data Logging and Optional Remote Monitoring Unit

Water heater data e.g. burning hours, no. of ignitions, flame errors, and errors history (last 15 faults) are stored in the controller memory, and available for viewing on the controller, or at the BMS via the optional remote monitoring unit, which reformats the data into Modbus format for the BMS.

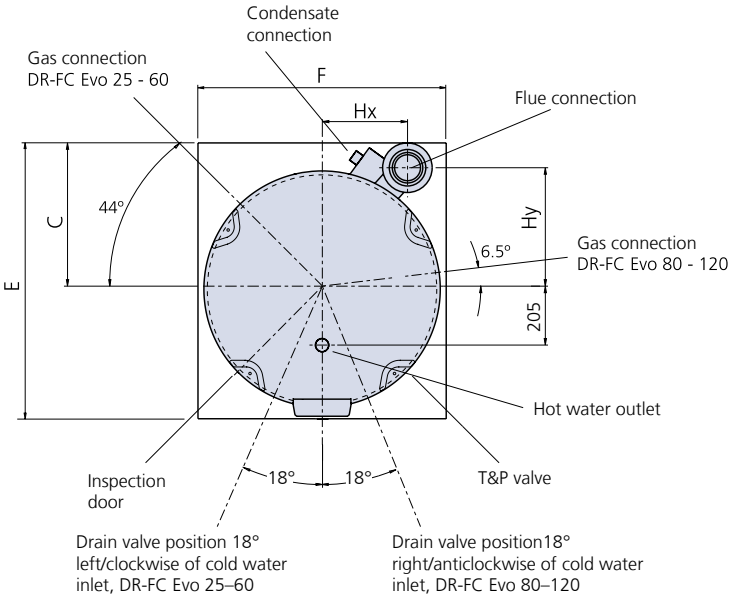
Technical Data

Dorchester DR-FC Evo

		Description	Unit	DR-FC Evo 25	DR-FC Evo 30	DR-FC Evo 45	DR-FC Evo 60	DR-FC Evo 80	DR-FC Evo 95	DR-FC Evo 120
Water		Continuous output with 44°C ΔT (1st hour output)	l/h (l)	600 (730)	630 (870)	970 (1300)	1200 (1500)	1700 (1900)	2000 (2200)	2400 (2600)
		Continuous output with 50°C ΔT (1st hour output)	l/h (l)	530 (630)	560 (730)	850 (1100)	1100 (1300)	1500 (1700)	1700 (1900)	2100 (2300)
		Continuous output with 55°C ΔT (1st hour output)	l/h (l)	480 (560)	510 (640)	780 (930)	930 (1100)	1300 (1500)	1600 (1700)	1900 (2000)
		Storage capacity	litres	227	386			504		
		Maximum operating water pressure (open vented)	bar	8						
		Maximum operating water pressure (unvented)	bar	5.5						
		Expansion relief valve setting (open vented kit)	bar	5						
Energy		Building Regulations thermal efficiency gross	%	96	98	96	95	97	95	95
		Heating-up time, ΔT = 44°C	min.	23	37	24	20	19	16	13
		Heating-up time, ΔT = 50°C	min.	26	42	27	23	21	18	15
		Heating-up time, ΔT = 55°C	min.	29	46	30	25	23	20	16
		Standby losses	kW/24h	4.2	4.7			6.7		
Gas	Nat. Gas G20 20mbar	Input, gross–maximum	kW	31.6	32.6	51.2	62.1	85.0	103.4	126.3
		Output–maximum	kW	30.5	32.0	49.3	59.3	82.6	98.7	119.4
		Gas inlet pressure–nominal	mbar	20						
		Gas flow rate–maximum@1013.25 mbar and 15°C	m^3/h	3.1	3.2	5.0	6.0	8.3	10.1	12.3
	LPG G31 37mbar	Input, gross–maximum	kW	31.0	32.0	50.1	60.8	83.2	101.2	123.6
		Output–maximum	kW	30.5	32.0	49.3	59.3	82.6	98.7	119.4
		Gas inlet pressure–nominal	mbar	37						
		Gas flow rate–maximum@1013.25 mbar and 15°C	kg/h	2.3	2.3	3.7	4.4	6.1	7.4	9.0
Flue		Approximate flue gas volume @15°C, 9.8% CO_2, N.T.P. (Nat. Gas-G20)	m^3/h	37.3	38.5	60.2	72.3	103.1	125.5	152.8
		Flue gas temperature–maximum	°C	45	50	60	65	50	55	60
		NOx emission, dry air free,European Class 5. Maximum (at part load)	mg/ kWh	52.8	51.0	51.0	47.5	54.6	52.8	51.0
		Pressure at the flue outlet only (B23) with zero pressure at air inlet	Pa	52	62	133	173	88	126	180
Electrical		Start current–maximum (maximum power)	A (W)	0.59 (135)				0.61 (140)		
		Run current–maximum (maximum power)	A (W)	0.2 (45)	0.2 (45)	0.32 (75)	0.5 (115)	0.41 (95)	0.63 (145)	1.05 (240)
		Electrical supply	VAC	230 V 1PH 50Hz						
		Voltage tolerance	% of VAC	-15% +10%						
Misc.		Noise level @2m from flue terminal	dB(A)	<45						
		Number of (power) anodes	-	1	2					
		Weight when empty	kg	202	239			480		
		Approximate shipping weight	kg	221	260			501		
		Maximum floor load/ weight filled with water	kg	429	625			984		

Dimensional Details

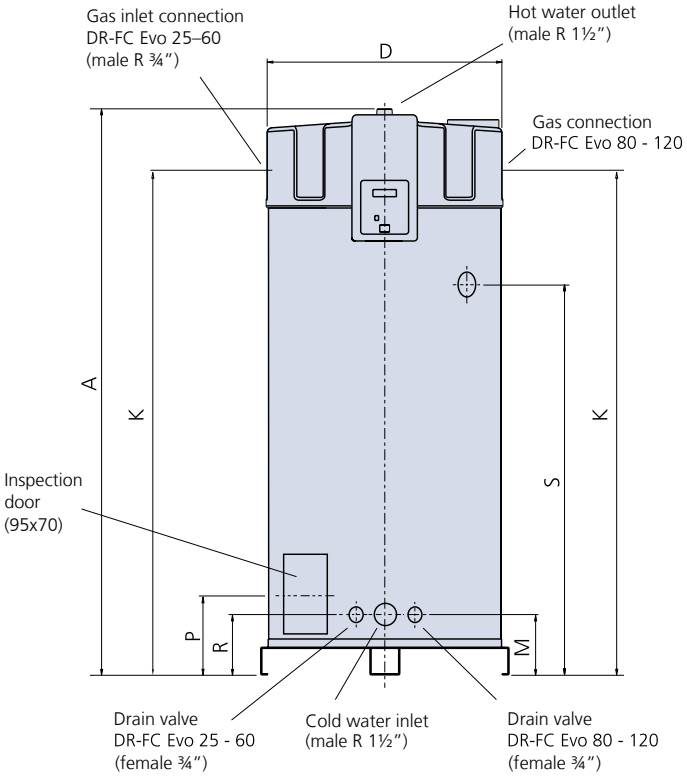
Dorchester DR-FC Evo



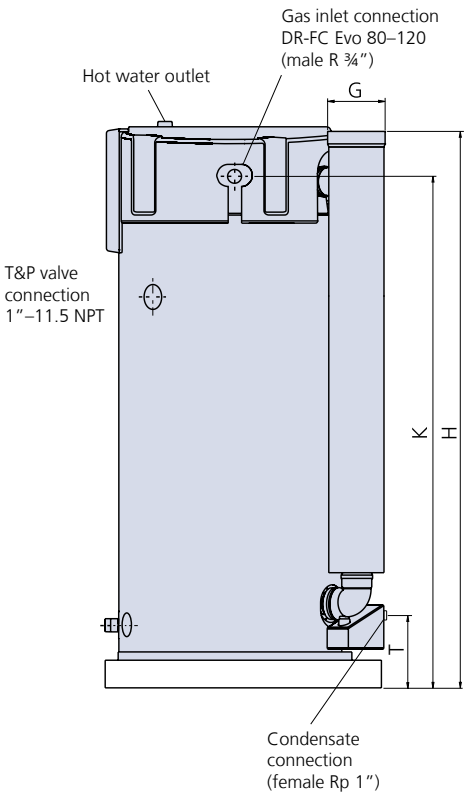
Plan View

Clearances:
100cm above top of water heater,
100cm around controls and inspection doors.
50cm around all other sides of water heater.

Note: Flue gas sampling point access must be restricted if the water heater is to be fitted in the corner of the room. If so, a loose sampling point adapter is available as an option, which can be fitting during installation at a more accessible position in the flue, as required.



Front View



Side View

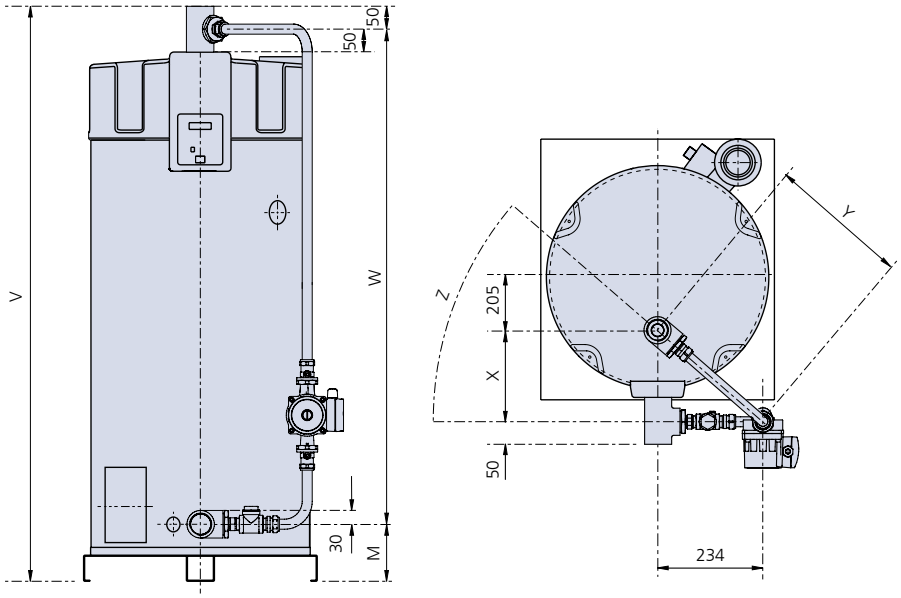
Dimensional Details

Dimensional Details

Ref	Dimensions/mm	Water Heater Model						
		DR-FC Evo 25	DR-FC Evo 30	DR-FC Evo 45	DR-FC Evo 60	DR-FC Evo 80	DR-FC Evo 95	DR-FC Evo 120
A	Total height	1485	2005			2060		
C	Position on base	490				1100		
D	Water heater diameter	705				850		
E	Depth	925				1000		
F	Width	850				900		
G	Diameter for flue gas discharge	100/150				130/200		
H	Height of flue gas outlet/air supply	1460	2000			1995		
Hx	x position flue gas outlet	265				310		
Hy	y position flue gas outlet	375				440		
K	Height of gas connection	1365	1895			1855		
M	Height of cold water inlet	265	255			225		
N	Height of hot water outlet	1485	2005			2060		
P	Height of cleaning opening	265	270			290		
R	Height of drain valve connection	180	170			225		
S	Height of T&P valve connection	995	1505			1425		
T	Height of condensation drain	220	240					
V	*Total height with recirculation kit	1576	2086			2141		
W	*Height (between pipe centres)	1261	1781			1866		
X	*Connections horizontal offset	214				316		
Y	*Pipe length	318				394		
Z	*Pipe angle/degrees	42°				53°		

*For/with optional top-to-bottom recirculation kit

Optional Top-to-Bottom Recirculation Kit Dimensions



All dimensions in mm

Front View

Plan View

System Schematics

Dorchester DR-FC Evo

Unvented Cold Water Supply

Typical pipework arrangement for a single Dorchester DR-FC Evo water heater on an unvented system.

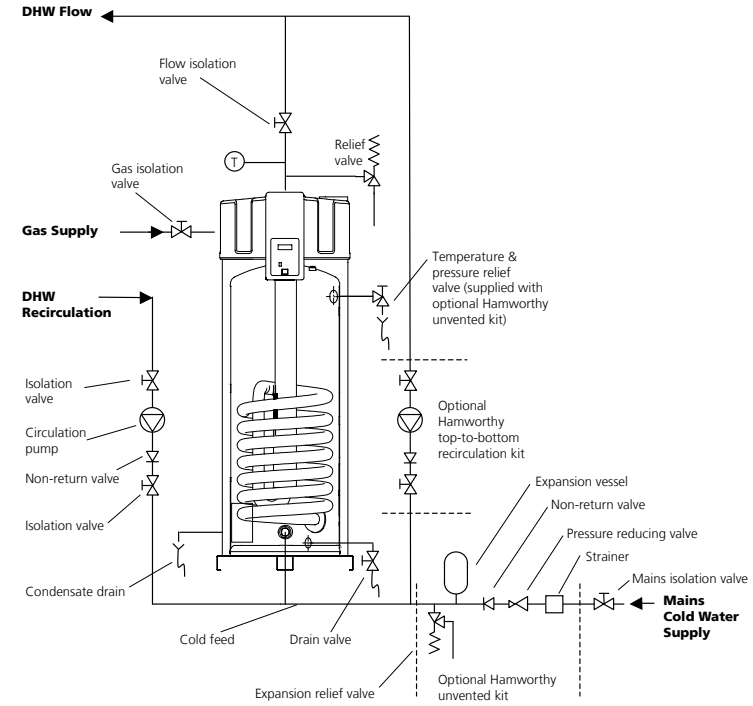
The Water Supply (Water Fittings) regulations 1999 require a number of essential controls pre-set to specific pressure and temperature settings for unvented systems. To ensure the controls are correctly sized for the application, set to appropriate levels and assembled in the correct order, Hamworthy Heating offer the unvented kit, a single "water train" with a separate T&P (temperature and pressure) relief valve sized to suit the energy input of the water heater. The T&P relief discharge should be via an air break to a tundish.

Each unvented supply kit is designed to be used with an individual water heater. Multiple heater installations require one unvented kit per water heater.

Larger systems with additional storage may require larger capacity expansion vessel.

Consult with Hamworthy Technical for a full range of Hamworthy expansion vessels.

Unvented Cold Water Supply and Single Water Heater



Open Vented Cold Water Supply

Typical pipework arrangement for a single Dorchester DR-FC Evo water heater on an open vented system.

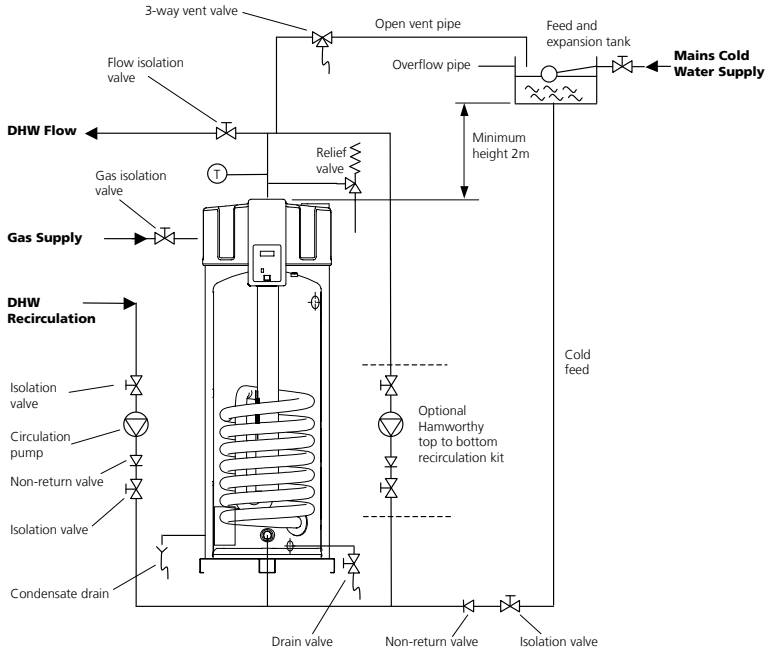
With open vented systems the feed and expansion tank must be sized to provide sufficient cold water storage and accommodate expanded system water without the risk of overflowing.

System operating pressure is directly related to the height of the feed and expansion tank. Care must be taken therefore to locate the feed and expansion tank such that it provides sufficient head pressure so that flow can be maintained at all outlets likely to be operating concurrently.

The minimum recommended height of the bottom of the feed and expansion tank above the water heater is 2m.

For comprehensive recommendations on the design, installation and testing of services supplying water within buildings please refer to BS 6700.

Open Vented Cold Water Supply and Single Water Heater



System Schematics

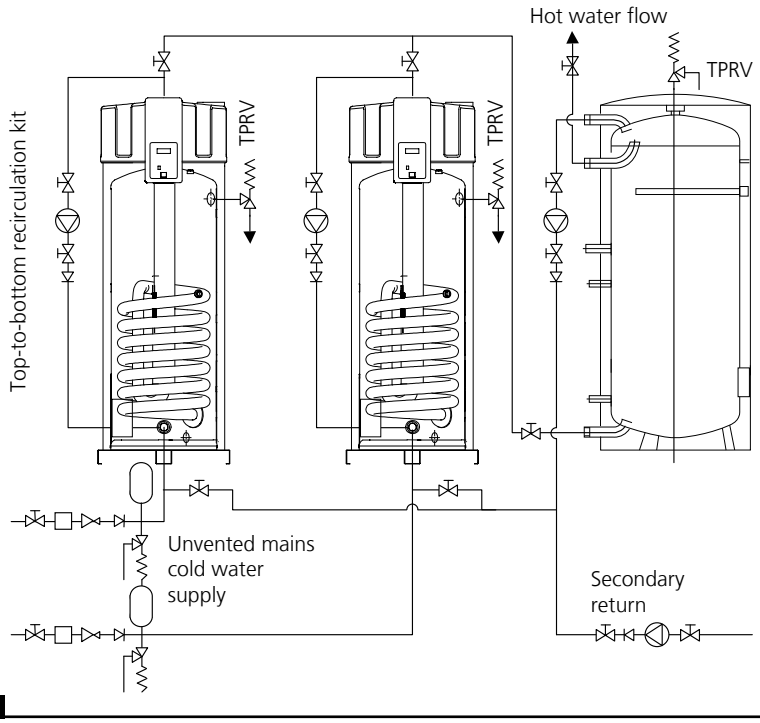
Dorchester DR-FC Evo

Unvented System: Two Water Heaters and One Storage Tank

Typical pipework arrangement for two Dorchester DR-FC Evo water heaters and an additional storage tank on an unvented system.

The loading pump circuit to the hot water storage tank must be run continuously throughout all anti-legionella purge periods, along with secondary circulation and top to bottom recirculation pumps to ensure the entire hot water system is fully heated to the required temperature.

Unvented System: Two Water Heaters and One Storage Tank



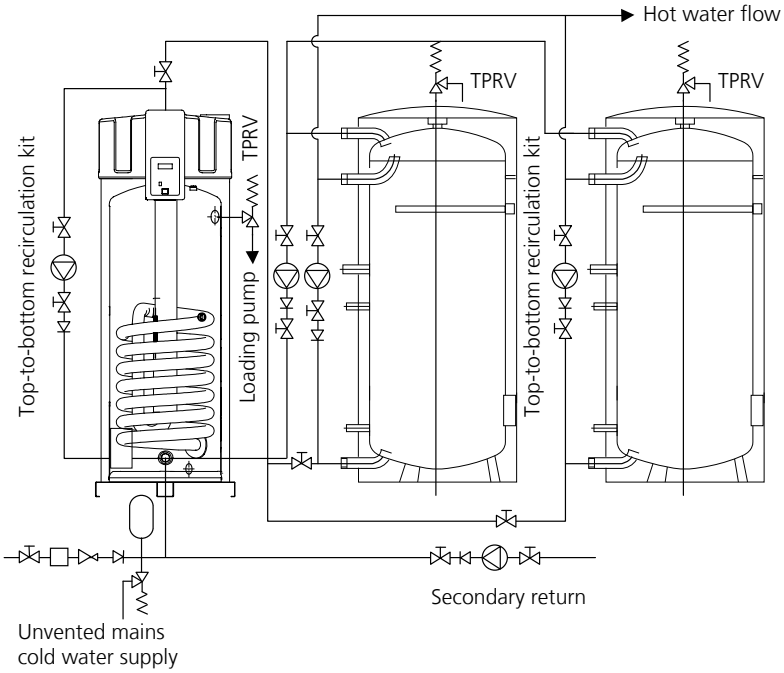
Unvented System: One Water Heater and Two Storage Tanks

Typical pipework arrangement for a single Dorchester DR-FC Evo water heater and two additional storage tanks on an unvented system.

When using additional storage tanks with unvented systems, the expansion vessel volume must be increased to accommodate the additional expansion vessels.

Consult with Hamworthy technical for a full range of Hamworthy expansion vessels.

Unvented System: One Water Heater and Two Storage Tanks



General Applications Information

Dorchester DR-FC Evo Gas, Water Supply, and DHW Circuits

Regulations

The installation of the water heater MUST be in accordance with the relevant requirements of the Gas Safety Regulations, Building Regulations, IET Regulations and the Water Supply (Water Fittings) Regulations. It should also be in accordance with any relevant requirements of the local gas region and local authority and the relevant recommendations of the following documents:

These British Standard Codes of Practice and additional publications have relevant recommendations regarding the installation of Dorchester DR-FC Evo water heaters.

British Standards

BS 5440 Part 1 Flueing and ventilation for gas appliances of rated input not exceeding 70kW net. Installation of gas appliances to chimneys, and for maintenance of chimneys.

BS 5440 Part 2 Flueing and ventilation for gas appliances of rated input not exceeding 70kW net. Installation and maintenance of ventilation provision for gas appliances.

BS 6644 Installation of gas-fired hot water boilers of rated inputs of between 70kW net and 1.8MW net.

BS 6700 Design, installation, testing and maintenance of services supplying water for domestic use.

BS 6798 Installation and maintenance of gas-fired boilers of rated input not exceeding 70kW net.

BS 6891 Installation of low pressure gas pipework of up to 35mm (R 1 ¼") in domestic premises. (2nd family gases).

BS7074 Part 1 Application, selection and installation of expansion vessels and ancillary equipment for sealed water systems. Code of practice for domestic heating and hot water supply.

BS 7671 Requirements for electrical installations. IET Wiring Regulations. Seventeenth edition.

BS EN 806-2 Specification for installations inside buildings conveying water for human consumption – Part 2: Design.

I. Gas E. Publications

IGE/UP/1 Strength testing, tightness testing and direct purging of industrial and commercial gas installations.

IGE/UP/1A Strength testing, tightness testing and direct purging of small low pressure industrial and commercial natural gas installations.

IGE/UP/2 Installation pipework on industrial and commercial premises.

IGE/UP/10 Installation of flued gas appliances in industrial and commercial premises.

Health & Safety Executive

Guidance note PM5—Automatically controlled steam and hot water boilers.

CIBSE Publications

CIBSE Guide H Building Control Systems

CIBSE Guide Energy Efficiency in Buildings

CIBSE Commissioning Code B: 2002

CIBSE TM13: Minimising the risk of Legionnaires' disease.

Department of Health

Health Technical Memorandum 04-01: The control of Legionella, hygiene, "safe" hot water, cold water and drinking water systems, Part A Design, installation and testing, Part B Operational Management

Third Edition of the 1956 Clean Air Act Memorandum

Department of the Environment, Scottish Development Department & Welsh Office.

Water System-Open Vented

For Hamworthy Dorchester DR-FC Evo open vented systems, the feed cistern and water supply from the feed system must be so sized as to ensure that the make-up water is equivalent to or exceeds the maximum draw off rate of the heater systems and any other system requirements. The hot water flow pipe from each heater must be fitted with a ¾" (20mm) relief valve and an open vent 1 ¼" (32mm) and a cold feed 1" (28mm) minimum.

No isolating valves should be fitted between the water heater and the draw off point for relief valve and open vent.

The maximum working head of the heater is 74m (242 feet). Dead legs to water draw off points should be as short as possible and in no case should they exceed the lengths laid down in the water supply (water fittings) regulations. These regulations state that the maximum lengths of pipe supplying a hot water draw off tap measured along the axis of the pipe from the heater, cylinder or tank from a secondary circuit are as listed below:

Pipes not greater than 19mm I/D—maximum dead leg is 12m.

Pipes in range 19–24mm I/D—maximum dead leg is 7.6m.

Pipes greater than 25mm I/D—maximum dead leg is 3m.

General Applications Information

Dorchester DR-FC Evo

Location

The location chosen for the water heater must permit the provision of a satisfactory flue system and an adequate air supply. The location must also provide adequate space for servicing and air circulation around each unit. This includes any electrical trunking laid along the floor and to the appliance.

The water heater mounting surface should be a non-combustible flat and level surface capable of supporting the weight of the water heater when full of water and any additional ancillary equipment.

Any combustible material adjacent to the water heater and the flue system must be so placed or shielded to ensure that its temperature does not exceed 65°C.

Adequate space to enable installation and servicing should be provided, with due consideration to ensuring access to the clean out door and removal of the burner assembly.

Layout

Dorchester DR-FC Evo water heaters are suitable for installation in either single or multiple configurations. If additional storage is required to meet peak demands the water heater can be connected to one or more storage tanks. If a storage tank is used an additional loading pump and thermostats are required to ensure proper control over the stored water temperature.

Water Quality

Due to the variable chemical composition of distributed water supplies it is necessary to identify the properties of the cold water feed to the water heater. In common with all types of water heating equipment, scale will develop during normal use and it is therefore essential that appropriate steps are taken to ensure reliable and continuous operation of the plant.

Contact should be made with the local water provider to determine the quality of the feed water and reference should be made to water treatment specialists for appropriate advice.

The water heater warranty requires that the conductivity of the water in the heater must be no less than 125 microsiemens/cm. This is necessary to ensure effective operation of the electrical anodic protection system.

There is no upper limit to water hardness, however where domestic feed water hardness is very high, water treatment should be considered to reduce the hardness. As hardness and conductivity are related, care should be taken not to soften the water to a point where the conductivity falls below 125 microsiemens/cm otherwise the anodic protection will be rendered ineffective. Harder water produces more scale and results in more frequent maintenance upstream of the water heater.

Condensate Discharge

When operating at suitable condensing temperatures, a condensing water heater has the potential to produce condensate at up to 13litres per hour per 100kW input energy.

A drain connection is fitted to the boiler to enable the disposal of condensate, which is mildly acidic, with a typical value 3.5pH, and can be disposed of normally through the drainage system. If in any doubt about local regulations, check with the local water authority.

The condensate drain on each water heater must be connected to a suitable drainage system using corrosion resistant material such as PVC plastic with glued sealed joints to prevent escape of condensate.

Drain traps and an open tundish should be incorporated into the design, and the pipework given appropriate protection from physical damage and frost.

The pipework should be installed with at least a 3 degree fall (approximately 50mm per metre).

Delivery

Dorchester water heaters are delivered factory assembled and mounted within frames, shrink-wrapped and on a steel pallet base which is fitted permanently to the unit.

All Hamworthy products are delivered to site on a tail-lift vehicle, and deliveries are closely co-ordinated with the customer, to suit the site construction programme. Standard delivery is to ground level from the tail-lift vehicle. To enquire about special delivery services, please contact our customer services team.

Commissioning

Hamworthy Heating Ltd strongly recommends that all water heaters are commissioned by their service department, who will issue an appliance log-book that details the initial operating settings, and which can be used to record all future maintenance work.

For more information on commissioning contact Hamworthy Heating Service Department.
Tel 0845 450 2866
or email service@hamworthy-heating.com

Maintenance

Installed water heaters will experience a wide variation in operating conditions that can occur due to differing patterns of usage and the variable chemical nature of distributed water supplies. It is therefore strongly recommended that water heaters be drained and inspected within 3 months of the initial commissioning. Once the levels of calcium deposition are established a suitable maintenance schedule can be implemented, however as a minimum all water heaters should be serviced annually.

Warranty

The Dorchester DR-FC Evo water heater carries a standard two year warranty on parts. Where the product is commissioned by Hamworthy Service Engineers, then the warranty also covers labour for the warranty period, subject to servicing and warranty conditions.

Air Supply and Ventilation

Dorchester DR-FC Evo

An adequate supply of fresh air for combustion and ventilation must be provided in accordance with BS5440 and BS644. Where Dorchester DR-FC Evo water heaters are installed as room sealed units, the air supply is for ventilation only. Air supply and ventilation must be sized for the entire plant. The combined net heat input of all gas fired appliances within the plant room or compartment must be used for these calculations.

Water Heater Installations <70kW Net Rated Input

Air supply and ventilation must be in accordance with BS5440

Compartment Ventilation – Open Flue		Compartment Ventilation – Room Sealed	
Direct to outside air	**To room or internal space**	**Direct to outside air**	**To room or internal space**
High level–5cm²/kW net input	High level–10cm²/kW net input	High level–5cm²/kW net input	High level–10cm²/kW net input
Low level–10cm²/kW net input	Low level–20cm²/kW net input	Low level–5cm²/kW net input	Low level–10cm²/kW net input

The areas quoted are minimum free areas for ventilation grilles. For further guidance refer to BS5440.

Plant Installations with Combined Heat Input >70kW Net

Air supply and ventilation must be in accordance with BS6644.

Open Flue Appliances

Compartment Ventilation – Open Flue	Plant Room Ventilation – Open Flue
Direct to outside air	**Direct to outside air**
High level–5cm²/kW net input	High level–2cm²/kW net input
Low level–10cm²/kW net input	Low level–4cm²/kW net input

Room Sealed Appliances

Compartment Ventilation – Room Sealed	Compartment Ventilation – Room Sealed	Plant Room Ventilation – Room Sealed
Direct to outside air	**To room or internal space**	**Direct to outside air**
High level–typically 5cm²/kW net input	High level–typically 10cm²/kW net input	High level–typically 2cm²/kW net input
Low level–typically 5cm²/kW net input	Low level–typically 10cm²/kW net input	Low level–typically 2cm²/kW net input

The areas quoted are minimum free areas for ventilation grilles. For net heat input, refer to technical data table on page 7. For further guidance refer to BS6644.

General Ventilation Requirements

Plant Room Temperatures

Additional requirement of BS6644 for multiple boiler installation requires that the air supplied for plant room ventilation shall be such that the maximum temperatures within the plant room do not exceed:

- At floor level, or 100mm above floor level: 25°C
- At mid-level, 1.5m above floor level: 32°C
- At ceiling height, or 100mm below ceiling height 40°C.

Ventilation Grille Openings

High and low level ventilation grilles shall be positioned as high and as low as practicable. Low level grills additionally shall be located within 1m of floor level for Natural gas and within 250mm of floor level for LPG. High level grilles are recommended to be positioned within 15% of the boiler height form the ceiling.

High and low level ventilation grilles shall communicate with the same room or internal space where compartment ventilation is used. Where ventilation grilles communicate directly with outside air they shall be positioned on the same wall.

Air Supply

The air supply should be free from contamination such as building dust and insulation fibres from lagging. To avoid unnecessary cleaning and servicing of the boiler modules the boilers should not be fired whilst building work is being undertaken.

Summer Operation

Where a boiler installation is to operate throughout the summer months, e.g. for domestic hot water production for more than 50% of the time, then additional ventilation allowances are required. *Refer to BS6644 for more information.*

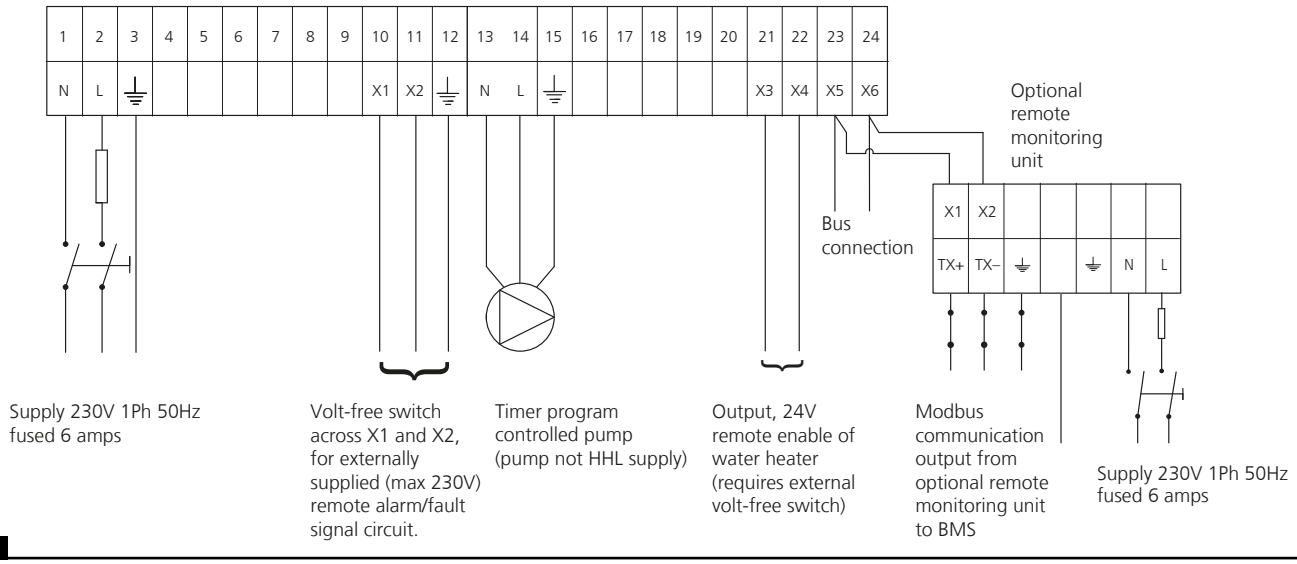
Electrical Details

Dorchester DR-FC Evo

The following electrical connections are provided on each water heater:

- Supply live, neutral and earth
- Alarm signal output (volt free contact)
- Timer programmed pump output
- Remote enable of water heater
- Bus connection for optional remote monitoring unit.

Fig 1 Control Panel Terminal Block (top of water heater)


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
N L X1 X2 N L X3 X4 X5 X6
Optional remote monitoring unit
X1 X2 TX+ TX– N L
Bus connection
Supply 230V 1Ph 50Hz fused 6 amps
Volt-free switch across X1 and X2, for externally supplied (max 230V) remote alarm/fault signal circuit.
Timer program controlled pump (pump not HHL supply)
Output, 24V remote enable of water heater (requires external volt-free switch)
Modbus communication output from optional remote monitoring unit to BMS
Supply 230V 1Ph 50Hz fused 6 amps

Electrical Connections

The electrical connection junction box is located within the upper casing section of the water heater to accept cables for power supply and controls. A single terminal rail is located within this junction box for all external connections.

Power Supply

An independent isolator and fused electrical supply is required for each water heater and remote monitoring unit for interfacing with a building management system (BMS). Supply 230 volt, 50Hz, single phase.

Wiring external to the heater and any optional remote monitoring unit must be in accordance with IET regulations and any local regulations which apply. Wiring must be completed in heat resistant cables, and mains supply cables should be 3-core cable, size 1.00mm2. External fuses should be 6 Amp.

Remote Alarm/Fault Signal

In the event of the water heater developing a fault, a common alarm signal is raised, which closes a normally-open volt-free switch to connect terminals X1 and X2 together. This can be used to complete a circuit switching on an externally powered (maximum 230V) fault indication lamp or alarm circuit (not HHL supply). At the same time as the switch is made, an error code associated with the fault is generated and displayed at the control panel to aid fault diagnosis.

Programmable Timer-controlled Pump

A 230V 50Hz single phase timer-controlled supply is provided for the direct control of a single pump only (maximum rating 150W) for system recirculation or top-to-bottom recirculation. If more than one pump is to be controlled at the same time by the water heater, then these should be supplied separately via contactors using the program controlled 230V power supply as the switching control signal. Pump operation can be co-ordinated to operate in tandem with the anti-legionella cycle as well as any programmed ON period.

Remote Enable

For external timer, BMS control, or remote manual control, each water heater can be controlled via a remote enable circuit, which, if enabled, switches ON the combustion heating circuit of the water heater, overriding the water heater's internal time clock program while ON.

The remote enable circuit operates at 24V supplied by the water heater with the water heater enabled when X3 and X4 are connected. Therefore any external control relay or switch wired across X3 and X4 must use volt-free contacts rated to 24V 1A with resistance no greater than 150Ω when closed. Wiring is not provided.

Optional Remote Monitoring Unit

Stored data can be made available to a BMS (Building Management System) via an optional Remote Monitoring Unit which act as an interface between the water heater controller and the BMS, converting the data into Modbus format.

The remote monitoring unit requires 230V 1ph 50Hz supply. Communication between the water heater remote monitor unit and BMS is via a 2-wire low-voltage communication bus.

Application & System Data

Unvented Hot Water Systems

Following revision of the model water bye-laws in 1986 and the subsequent publication of part G3 of the Building Regulations, provisions were issued for the essential safety requirements necessary on unvented hot water storage systems. These requirements are covered in law by the introduction of "The Water Supply (Water Fittings) Regulations 1999."

The safety system comprises of a number of essential controls pre-set to specific and very important pressure and temperature levels. To ensure that the controls are correctly sized for application, set to appropriate levels and assembled in the correct order, Hamworthy Heating have elected to offer the unvented kit as a single pre-assembled, WRAS approved, water 'train' with a separate temperature/ pressure relief valve sized to suit the input energy of the heater.

This policy considerably simplifies site installation leaving the installer to connect from the water main to the 'water train' and from the train to the heater.

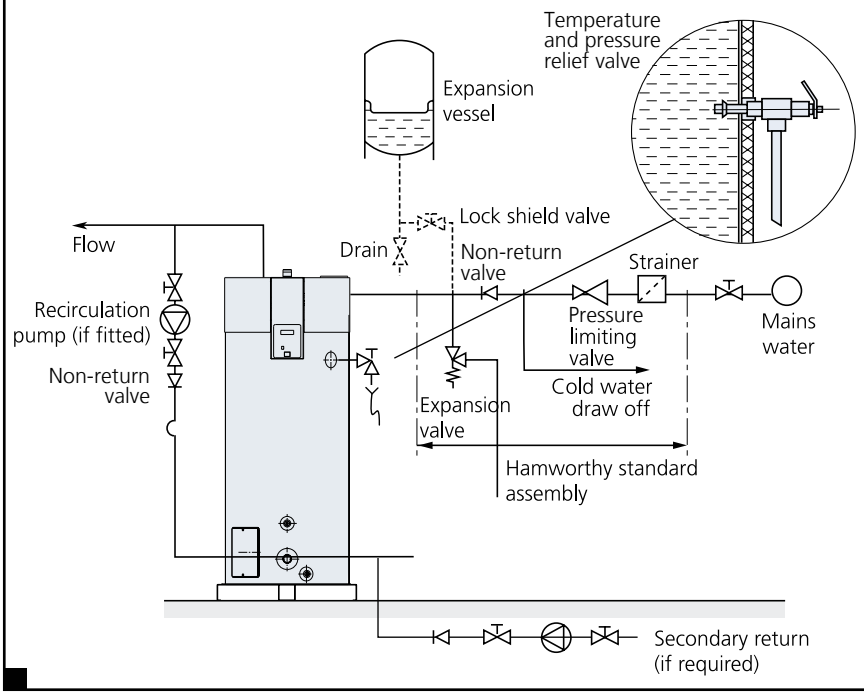
A dedicated socket is provided on all Dorchester DR-FC Evo water heaters exclusively for the fitment of the temperature and pressure relief valve, the discharge of which should be via an air break to a tundish.

Each unvented system kit is supplied with a 24 litre expansion vessel to accommodate the stored hot water expansion from the water heater. Due to the variable nature of hot water circuits an additional expansion vessel may be required to accommodate expansion from the hot water store within the distribution pipework or additional storage tanks where used.

Hamworthy can supply a range of expansion vessels up to 1000 litre capacity suitable for potable hot water systems to suit most requirements.

For comprehensive recommendations on the design, installation and testing of services supplying water within building, attention is drawn to the appropriate sections of B.S. 6700 1997, particularly clause 4 of section 2.

Hamworthy Unvented Kit



Expansion Vessel Sizing Calculation

Required expansion vessel volume (V_2) can be calculated using the following formula:

$$V_2 = \frac{\Sigma \times V_1}{1 - P_C/P_W}$$

Where V_2 = Required expansion vessel
V_1 = Total system volume (cylinder plus pipework)
Σ = Water expansion factor
P_C = Expansion vessel cushion pressure (absolute) + 1 bar
P_W = Working pressure (absolute) = Expansion valve setting + 1 bar

Expansion Factor for Different Water Temperatures

Temp °C	50	55	60	65	70
Expansion factor Σ	0.0118	0.0142	0.0168	0.0196	0.0225

Basic Pipework Volume Calculation

To calculate pipe volume for use in expansion vessel sizing calculation, use the formula:

Volume (litres) per metre = $0.0031428 \times r^2$

Where r = Internal radius = ((½ x Outside Diameter) - wall thickness), in mm
and L = length of pipe, in metres

Example

For a 10m length of EN 1057 copper pipe, 22mm outside diameter, with wall thickness 0.9 mm, the internal radius r = ((22/2) - 0.9) = 10.1mm.

Volume of water per metre = $0.0031428 \times r^2$
= 0.0031428 x 10.1 x 10.1
= 0.3206 litres/metre

Therefore total volume of water in 10m of pipe is 10 x 0.3206 = 3.206 litres.

Hot Water Sizing

Guidance Notes

The following notes are given for guideline purposes and the assumptions made are general. The diversification of hot water requirements are great and each particular application must be examined in detail.

General Guidelines

There are applications where sizing a water heater is a straightforward exercise. An obvious example is an industrial hot water load for a process requiring a specific amount of hot water, in a specified time at a specified temperature. All that is required is the lowest cold water supply temperature and the heater(s) output can be directly related to the amount of hot water required. If the load is continuous the heater or heaters must be sized to cope with the full amount. If the load is intermittent consideration can be given to a smaller heater installed in conjunction with a suitably sized storage tank.

Other types of installations which can be easily sized are sports pavilions and leisure centres, especially those catering for team games, when a known number of people will use showers, baths etc. at a known time. This is in effect the peak load when a large quantity of hot water may be dumped quickly since all showers may be running continuously. For sizing it is necessary to determine the duration of continuous use, which will depend on the maximum number of players using the showers. Showers can save water, but one shower running continuously for 1 hour can dump 328 l. Multiplied by 10 or 20 this can represent a large load which is best catered for by storage with a long recovery time. However, due consideration should be given to additional heaters and lower storage on the grounds of standby and cost.

The third category comprises almost all other commercial and industrial applications where hot water demand is random. To size the hot water requirement it is necessary to determine when the demand is greatest. Obviously if the water heater can cope with the peak demand, the remainder will be adequately catered for. However, the heater cannot be sized on the assumption that all outlet appliances will run continuously for 1 hour since this will result in gross over-sizing of heaters. Simple guidelines and common sense must be used to estimate appliance usage.

Listed below are a series of guidelines which may prove helpful in sizing Hamworthy water heaters.

Restaurants, Kitchens, etc., Serving Main Meals

Each meal will use: 9 litres at 60°C made up from: 3 litres preparation, 6 litres washing up.

The peak period would be spread over 1, 2 or 3 hours etc., depending on the establishment.

Bar sinks—allow 114 litres per hour.

School kitchens in general use 30% less than restaurants but allowance should be made for the number of sittings.

Hotels and Motels

Assume average occupancy as 1½ people per room unless specified as single rooms. Generally the peak will occur over a two hour period in the morning (7am-9am). In specialised hotels catering for specific functions (i.e. conferences) the peak could be reduced to one hour. For medium sized hotels with 100-200 people allow 25-35 litres hot water per person over two hour peak period. For smaller hotels allow more per person-for larger hotels allow slightly less. These figures assume that mainly showers are used, one per room.

Always check restaurant load to ensure that peak morning capacity will cover it. Overall, allow 115-135 litres per guest per day.

Dormitories

Allow 15 litres per man, 20 litres per woman over a peak 1 hour period.

Flats and Apartment Blocks

Assume average occupancy of 2½ people per flat. Allow 38 litres per person over a peak 3 hour period.

Rest and Convalescent Homes - with Kitchen and Laundry

Allow 38 litres per person over a peak 3 hour period.

Industrial Shower Rooms

Assume shower period to be 20 minutes at the end of each shift and that all showers and wash taps are running continuously for this period at full flow i.e. dump load ideal for heater plus storage application.

School Changing Rooms

Assume all showers and wash basins are used at full flow for 10 minutes after each gym period.

Offices

Allow 1.5 litres per person per hour for 1 hour peak load.

Commercial Laundry

Allow 13 litres per kg of wash at 71°C.

Hot Water Sizing

Guidance Notes

Launderettes

Determine the cycle time of the machines (add 10 minutes for unloading and reloading). Calculate the number of cycles that occur in one hour and multiply the number of machines and then multiply by the amount of hot water used by one machine in one cycle to arrive at the maximum demand.

Hairdressers and Beauty Salons

Allow 280 litres per hour of water at 60°C per wash basin per peak demand.

Hospitals etc.

Demand will depend on the type of hospital, nursing home, etc. Overall consumption per person per day of hot water can range between 70 litres - 230 litres.

In all applications it is desirable to cross check general assumptions with actual flow rates and capacities and in applications where no general guidelines exist it may be necessary to calculate hot water demand by listing the number and type of appliance in use.

The following tables give the approximate flow rates for standard hot or mixed water fittings and the approximate capacity in normal use. By appraising what function appliances perform it is possible to determine peak usage i.e. three baths per hour, two showers each of 10 minutes, sinks filled one per hour, etc.

Fitting	Flow Rate/ litres/second
Wash basin tap	0.15
Wash basin spray tap	0.05
Bath tap	0.30
Sink tap 15mm	0.20
Sink tap 20mm	0.30
Shower spray head	0.15
Shower 100mm rose	0.40

Approximate Mixed, Hot and Cold Capacities of Appliances in Normal Use

Cold water 10°C, hot water 60°C, mixed water 40°C

Appliance	Capacity in Normal Use/ litres	Amount of Hot Water/ litres	Amount of Cold Water/ litres	Temperature in Use/ litres
Wash basin	5	3.0	2.0	40
Bath	80	48.0	32.0	40
Small sink	12	7.2	4.8	40
Large sink	18	10.8	7.2	40
1 min shower spray	9	5.4	3.6	40
5 min shower spray	45	27	18.0	40
1 min shower (100mm rose)	24	14.4	9.6	40
5 min shower (100mm rose)	120	72.0	48.0	40

The quantities of hot water shown above are only correct to those particular temperatures. For other combinations use the following formula to determine the proportion of hot water.

$$\text{Quantity of hot water} = \text{capacity of appliance} \times \frac{\text{Mixed water temperature} - \text{Cold water temperature}}{\text{Hot water temperature} - \text{Cold water temperature}}$$

Factors at Various Cold Water and Mixed Water Temperature for Determining Hot Water Quantity at 60°C

As a further example, the table opposite gives the factors by which the capacity of an appliance is multiplied to obtain the quantity of hot water required when stored at 60°C for various cold water supply temperatures and various mixed water temperatures.

Cold Water Supply Temperature	Mixed Water Temperature						
	60°C	55°C	50°C	45°C	40°C	35°C	30°C
5°C	1.0	0.91	0.82	0.73	0.64	0.55	0.45
10°C	1.0	0.90	0.80	0.70	0.60	0.50	0.40
15°C	1.0	0.89	0.78	0.67	0.55	0.44	0.33
20°C	1.0	0.88	0.75	0.63	0.50	0.38	0.25

Hot Water Sizing

Dorchester DR-FC Evo

Having established the number of appliances, the usage, and the quantity of hot water required, the outputs of the heaters must be related to the hot water storage temperature. Any decrease in the cold water supply temperature or increase in the hot water storage temperature will result in a decreased output from the heater.

The output figures given are based on a rise in the temperature of 44°C i.e. with a storage temperature of 60°C the cold water supply must be at 16°C. The following table indicates the continuous output capability of each water heater at different values of temperature rise across the heaters. (Flow temperature - cold feed temperature).

The normal maximum storage temperature is 60°C and hence 55°C is the maximum rise expected across the heater with a cold water supply temperature of 5°C. It is possible however that for certain applications a higher storage temperature will be required when, if the cold water supply temperature remains at 5°C the calorifier outputs will be further reduced.

The question of additional storage if required and how much should be looked at in light of general consumption throughout the day, recovery times, whether the peak period is spread over 1 hour or 3 hours and whether a larger storage buffer than the calorifiers own storage is required to guard against the possibility of high flow rates at peak time.

Where the installation requires the use of large volumes of hot water over short periods and a storage tank is specified, a loading pump will be required to transfer hot water from the calorifier into the storage tank. This should be a bronze pump and sized to suit the continuous output of the water heater under design temperature conditions.

It is important that cold water supply capacities and pressures as well as pipe work layouts are suitable for high volume draw off at peak times to ensure satisfactory hot water delivery to draw off points.

One or more storage tanks may be used in conjunction with Powerstock calorifiers to satisfy hot water demand.

Maximum Continuous Output (litres/hour) at Different Levels of Temperature Rise across Water Heater from Cold Feed to Hot Flow

Model	Units	Maximum Continuous Output					
		Temperature Rise Across Water Heater (Flow Temperature – Cold Feed Temperature)					
		40°C	44°C	50°C	56°C	60°C	70°C
DR-FC Evo 25	l/h	660	600	530	471	440	380
DR-FC Evo 30	l/h	693	630	560	495	462	400
DR-FC Evo 45	l/h	1067	970	850	762	711	610
DR-FC Evo 60	l/h	1320	1200	1100	943	880	730
DR-FC Evo 80	l/h	1870	1700	1500	1336	1247	1100
DR-FC Evo 95	l/h	2200	2000	1700	1571	1467	1300
DR-FC Evo 120	l/h	2640	2400	2100	1886	1760	1500

Powerstock Storage Tanks

Hot Water Storage

Powerstock hot water storage tanks are the perfect partner for Dorchester water heaters where large volumes of hot water are required with intermittent use.

Available in 300, 500, 750 and 1000 litre capacities, these high quality glass lined storage tanks can be installed in single or multiple configurations to match the hot water demand.

Powerstock storage tanks are WRAS approved and suitable for both unvented and open vented applications.

Options

- **Unvented supply kit**
- **Top to bottom pump recirculation kit**
- **Electrical anode protection**
- **Electric immersion heater kit**

For further details of Powerstock Storage Tanks, refer to brochure 500002488.

Flue Systems

Dorchester DR-FC Evo

The Dorchester DR-FC Evo water heaters are designed to operate as room sealed appliances or in open flue systems, and are available with a choice of flue options using a range of matched components to provide versatility in where the water heater can be located. Options are available for room sealed concentric or twin duct, or open flue single pipe arrangements.

Balanced flues can reduce the cost of installation and simplify flue runs. Room sealed configurations reduce the volume of ventilation air required, resulting in tighter and more energy-efficient buildings. Open flue applications provide solutions where balanced flue terminals are unsuitable, or where existing flue routes are to be retained.

Flue System Construction

The flue system must be capable of handling saturated flue gases. Flue construction should be fully welded and CE marked for positive pressure application. All Hamworthy flue components have been matched and tested specifically for use with these water heaters. This ensures optimum performance from the installation and simplifies the necessary sizing calculations.

The flue is constructed from aluminium for twin duct and open flue arrangements (single wall) and for the inner wall of concentric flue components. The outer wall of concentric flue components is constructed from galvanised steel, with the concentric ring carrying the combustion air to the appliance, which also acts as the insulation to the inner duct, which carries the exhaust flue gases.

Flue pipes are joined with a simple push fit connection with a silicone seal ensures water and pressure tight joints every time and clamp bands complete the installation.

Single Water Heaters with Individual Flue System

Each individual Dorchester DR-FC Evo can be installed with a flue system from either the room sealed or open flue type solutions. Room sealed units must be installed with individual air supply ducts and flue discharge systems.

Multiple Water Heater Flue System Design—Open Flues System Only

It is permissible to install multiple Dorchester DR-FC Evo water heaters on open flue systems only. Water heaters using room sealed flues should be installed with individual flue systems, and not connected into a header type arrangement for the ducted air supply nor flue discharge.

Flues Scheme Definitions

Flue systems are defined in accordance with European schemes defined in PD CR 1749:2001 and summarised in the table at the bottom of this page.

Supported Flue Schemes

The Dorchester DR-FC Evo water heater supports the following flue schemes:

Room Sealed Flue Systems

- Concentric flue systems type C13–Horizontal termination
- Concentric flue systems type C33–Vertical termination
- Twin duct flue systems type C53–Vertical flue termination with Horizontal air inlet

Conventional Open Flue Systems

- Open flue systems type B23–Vertical termination

Note. Open flue applications can use the same flue components as the twin duct room sealed system.

Ordering Flues

Flues are ordered separately from the water heater. To simplify the selection process, Hamworthy have a flue order form available for the Dorchester DR-FC Evo.

To order flues, telephone 0845 450 2865 or email sales@hamworthy-heating.com to request an order form, and state:

- *Water heater model*
- *Installation type (B23, C13, C33 or C53)*

PD CR 1749:2001 Flue Scheme Definitions

Room Sealed

Type C - An appliance in which the combustion circuit (air supply, combustion chamber, heat exchanger and evacuation of the products of combustion) is sealed with respect to the room in which the appliance is installed.

Type C1 - A type C appliance that is designed for connection via its ducts to a horizontal terminal, which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices that are either concentric or close enough to come under similar wind conditions.

Type C3 - A type C appliance that is designed for connection via its ducts to a vertical terminal, which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices that are either concentric or close enough to come under similar wind conditions.

Type C5 - A type C appliance connected to separate ducts for the supply of combustion air and the evacuation of the products of combustion. These ducts may terminate in zones of different pressure.

Type C13 - A type C1 appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

Type C33 - A type C3 appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

Type C53 - A type C5 appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

Open Flue

Type B - An appliance intended to be connected to a flue that evacuates the products of combustion to the outside of the room containing the appliance. The combustion air is drawn directly from the room.

Type B2 - A type B appliance without a draught diverter.

Type B23 - A type B2 appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

For details of the full range of classifications refer to BSI publication PD CR 1749:2001.

Flue Systems

Dorchester DR-FC Evo
Open Flue Systems, Type B23

Dorchester DR-FC Evo open flues are arranged for air supply directly from the plant room with vertical flue discharge.

Ducting between the heater and the flue terminal is made using single tubes. Table 1 provides details of the maximum flue length and equivalent bend lengths.

Where longer flue routes are required then it is possible to increase the diameter for the flue duct between the heater and the flue terminal. The final connection diameters at the heater and the flue terminal remain the same, so expansion and reduction pieces are used to facilitate the diameter change at each end of the flue pipe. Table 2 provides details of the maximum flue length and equivalent bend lengths.

Table 3 summarises the maximum flue pressures for all applicable flue system types.

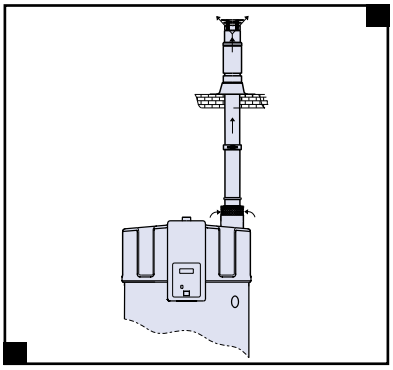


Table 1–Open Flue With Vertical Flue Terminal, Type B23-A

Model	Diameter/mm	Maximum Length/m	Elbow equiv. length/m	
			90°	45°
DR-FC Evo 25	100	55	4.6	1.2
DR-FC Evo 30	100	55	4.6	1.2
DR-FC Evo 45	100	55	4.6	1.2
DR-FC Evo 60	100	55	4.6	1.2
DR-FC Evo 80	130	65	2.4	1.4
DR-FC Evo 95	130	65	2.4	1.4
DR-FC Evo 120	130	65	2.4	1.4

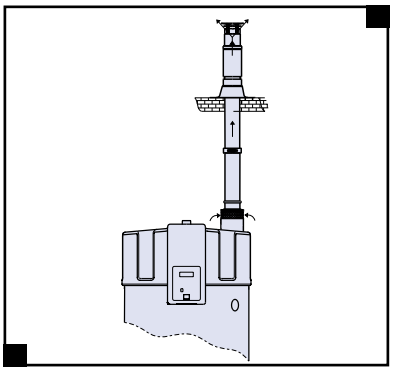


Table 2–Open Flue With Enlarged Diameter Duct Between Heater And Terminal, And Vertical Terminal, Type B23-B

Model	Diameter/mm		Maximum Length/m	Elbow equiv. length/m	
	Duct	Terminal		90°	45°
DR-FC Evo 25	100	100	100	2.4	1.4
DR-FC Evo 30	130	100	100	2.4	1.4
DR-FC Evo 45	130	100	100	2.4	1.4
DR-FC Evo 60	130	100	100	2.4	1.4
DR-FC Evo 80	150	130	100	2.6	1.6
DR-FC Evo 95	150	130	100	2.6	1.6
DR-FC Evo 120	150	130	100	2.6	1.6

Table 3–Maximum Flue Gas Pressure For B23, C13, C33 And C53 Type Flue Systems

Model	Maximum Flue Gas Pressure			
	Outlet only (B23)		Inlet + Outlet (C13, C33 and C53)	
	P_{inlet} /mBar	P_{outlet}/mBar	P_{inlet} /mBar	P_{outlet}/mBar
DR-FC Evo 25	0	0.52	-0.26	0.26
DR-FC Evo 30	0	0.62	-0.32	0.32
DR-FC Evo 45	0	1.33	-0.69	0.69
DR-FC Evo 60	0	1.73	-0.90	0.90
DR-FC Evo 80	0	0.88	-0.47	0.47
DR-FC Evo 95	0	1.26	-0.67	0.67
DR-FC Evo 120	0	1.80	-0.96	0.96

Flue Systems

Dorchester DR-FC Evo
Concentric, Room Sealed Flue Systems Type C13

The Dorchester DR-FC Evo can be flued with horizontal discharge through concentric terminals.

Ducting from heater to terminal can be made using concentric tubes. Table 4 provides details of the maximum length of flue and the permitted number of bends within an individual flue system.

Where longer flue routes are required it is possible to use individual air supply and flue ducts heater converging at the concentric terminal, reducing the flue system resistance and permitting the extended length. Table 5 provides details of the maximum flue length and equivalent bend lengths.

If still longer flue lengths are required then it is possible to increase the diameter for the air supply and flue ducts between the heater and the terminal. The final connection sizes at the heater and concentric terminal remain the same, so expansion and reduction pieces are used to facilitate the size change at each end of both the air supply and flue pipe. Table 6 provides details of the maximum flue length and equivalent bend lengths.

Table 3 on page 21 summarises the maximum flue pressures for all applicable flue system types.

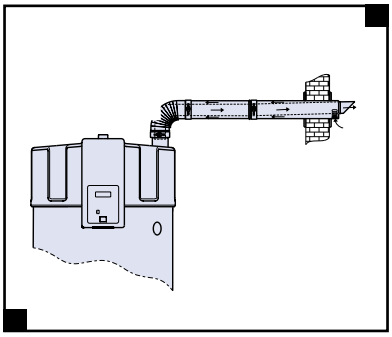


Table 4–Concentric Balanced Flue With Horizontal Terminal, Type C13-A

Model	Diameter/mm	Maximum Length/m	Max. no. of 45° or 90° bends
DR-FC Evo 25	100/150	40	7
DR-FC Evo 30	100/150	40	7
DR-FC Evo 45	100/150	40	7
DR-FC Evo 60	100/150	40	7
DR-FC Evo 80	130/200	15	4
DR-FC Evo 95	130/200	15	4
DR-FC Evo 120	130/200	15	4

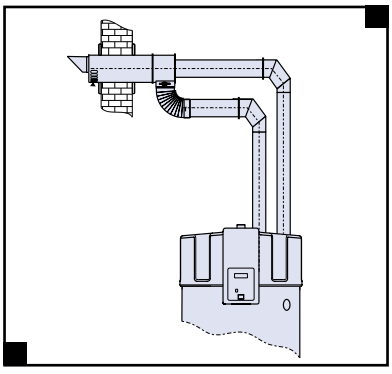


Table 5–Parallel Balanced Flue With Concentric Horizontal Terminal, Type C13-B

Model	Diameter/mm		Maximum Length/m	Elbow equiv. length/m	
	Duct	Terminal		90°	45°
DR-FC Evo 25	100	100/150	55	4.6	1.2
DR-FC Evo 30	100	100/150	55	4.6	1.2
DR-FC Evo 45	100	100/150	55	4.6	1.2
DR-FC Evo 60	100	100/150	55	4.6	1.2
DR-FC Evo 80	130	130/200	65	2.4	1.4
DR-FC Evo 95	130	130/200	65	2.4	1.4
DR-FC Evo 120	130	130/200	65	2.4	1.4

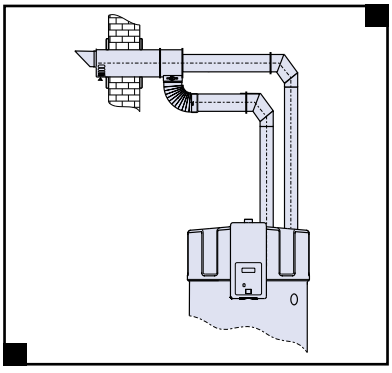


Table 6–Enlarged Parallel Balanced Flue With Concentric Horizontal Terminal, Type C13-C

Model	Diameter/mm		Maximum Length/m	Elbow equiv. length/m	
	Duct	Terminal		90°	45°
DR-FC Evo 25	130	100/150	100	2.4	1.4
DR-FC Evo 30	130	100/150	100	2.4	1.4
DR-FC Evo 45	130	100/150	100	2.4	1.4
DR-FC Evo 60	130	100/150	100	2.4	1.4
DR-FC Evo 80	150	130/200	100	2.6	1.6
DR-FC Evo 95	150	130/200	100	2.6	1.6
DR-FC Evo 120	150	130/200	100	2.6	1.6

Flue Systems

Dorchester DR-FC Evo
Concentric, Room Sealed Flue Systems Type C33

The Dorchester DR-FC Evo can be flued with vertical discharge through concentric terminals.

Ducting from heater to terminal can be made using concentric tubes. Table 7 provides details of the maximum length of flue and the permitted number of bends within an individual flue system.

Where longer flue routes are required it is possible to use individual air supply and flue ducts heater converging at the concentric terminal, reducing the flue system resistance and permitting the extended length. Table 8 provides details of the maximum flue length and equivalent bend lengths.

If still longer flue lengths are required then it is possible to increase the diameter for the air supply and flue ducts between the heater and the terminal. The final connection sizes at the heater and concentric terminal remain the same, so expansion and reduction pieces are used to facilitate the size change at each end of both the air supply and flue pipe. Table 9 provides details of the maximum flue length and equivalent bend lengths.

Table 3 on page 21 summarises the maximum flue pressures for all applicable flue system types.

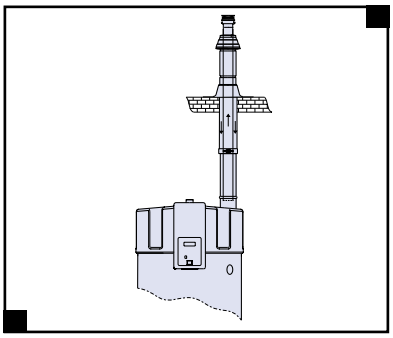


Table 7–Concentric Balanced Flue With Vertical Terminal, Type C33-A

Model	Diameter/mm	Maximum Length/m	Max. no. of 45° or 90° bends
DR-FC Evo 25	100/150	40	7
DR-FC Evo 30	100/150	40	7
DR-FC Evo 45	100/150	40	7
DR-FC Evo 60	100/150	40	7
DR-FC Evo 80	130/200	15	4
DR-FC Evo 95	130/200	15	4
DR-FC Evo 120	130/200	15	4

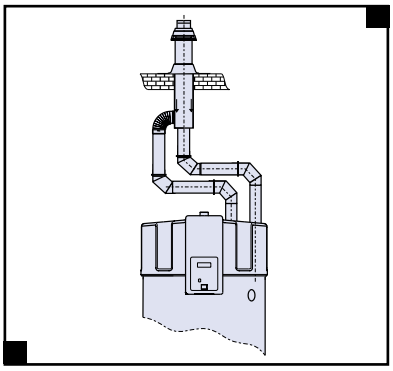


Table 8–Parallel Balanced Flue With Concentric Vertical Terminal, Type C33-B

Model	Diameter/mm		Maximum Length/m	Elbow equiv. length/m	
	Duct	Terminal		90°	45°
DR-FC Evo 25	100	100/150	55	4.6	1.2
DR-FC Evo 30	100	100/150	55	4.6	1.2
DR-FC Evo 45	100	100/150	55	4.6	1.2
DR-FC Evo 60	100	100/150	55	4.6	1.2
DR-FC Evo 80	130	130/200	65	2.4	1.4
DR-FC Evo 95	130	130/200	65	2.4	1.4
DR-FC Evo 120	130	130/200	65	2.4	1.4

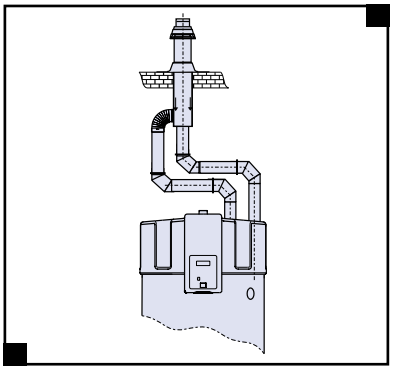


Table 9–Enlarged Parallel Balanced Flue With Concentric Vertical Terminal, Type C33-C

Model	Diameter/mm		Maximum Length/m	Elbow equiv. length/m	
	Duct	Terminal		90°	45°
DR-FC Evo 25	130	100/150	100	2.4	1.4
DR-FC Evo 30	130	100/150	100	2.4	1.4
DR-FC Evo 45	130	100/150	100	2.4	1.4
DR-FC Evo 60	130	100/150	100	2.4	1.4
DR-FC Evo 80	150	130/200	100	2.6	1.6
DR-FC Evo 95	150	130/200	100	2.6	1.6
DR-FC Evo 120	150	130/200	100	2.6	1.6

Flue Systems

Dorchester DR-FC Evo
Twin Duct, Room Sealed Flue Systems, Type C53

Dorchester DR-FC Evo room sealed flues can be arranged for horizontal air supply and vertical flue discharge.

Ducting between the heater and the air/flue terminals is made using single tubes. Table 10 provides details of the maximum length and equivalent bend lengths.

Where longer flue routes are required then it is possible to increase the diameter for the air supply and flue ducts between the heater and the air/flue terminals. The final connection sizes at the heater and terminals remain the same, so expansion and reduction pieces are used to facilitate the size change at each end of both the air supply and flue pipe. Table 11 provides details of the maximum flue length and equivalent bends.

Table 3 on page 21 summarises the maximum flue pressures for all applicable flue system types.

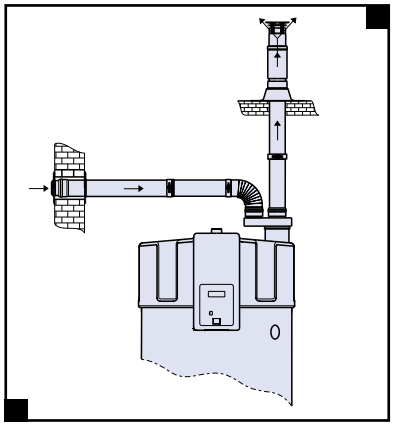


Table 10–Twin-Duct Horizontal Air Inlet With Vertical Flue Terminal, Type C53-A

Model	Diameter/ mm	Maximum Length/m	Elbow equiv. length/m	
			90°	45°
DR-FC Evo 25	100	55	4.6	1.2
DR-FC Evo 30	100	55	4.6	1.2
DR-FC Evo 45	100	55	4.6	1.2
DR-FC Evo 60	100	55	4.6	1.2
DR-FC Evo 80	130	65	2.4	1.6
DR-FC Evo 95	130	65	2.4	1.6
DR-FC Evo 120	130	65	2.4	1.6

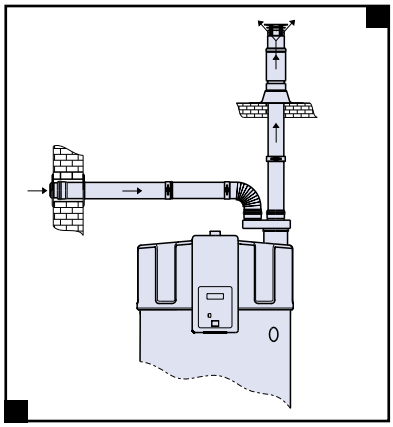


Table 11–Twin-Duct Horizontal Air Inlet With Vertical Flue Terminal—With Enlarged Diameter Duct Between Heater And Terminals, Type C53-B

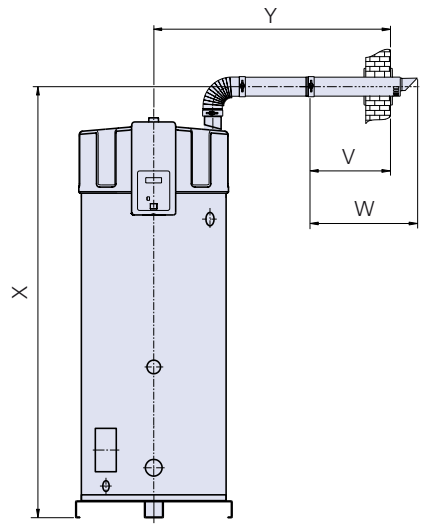
Model	Diameter/mm		Maximum Length/m	Elbow equiv. length/m	
	Duct	Terminal		90°	45°
DR-FC Evo 25	130	100	100	2.4	1.4
DR-FC Evo 30	130	100	100	2.4	1.4
DR-FC Evo 45	130	100	100	2.4	1.4
DR-FC Evo 60	130	100	100	2.4	1.4
DR-FC Evo 80	150	130	100	2.6	1.6
DR-FC Evo 95	150	130	100	2.6	1.6
DR-FC Evo 120	150	130	100	2.6	1.6

Flue Systems

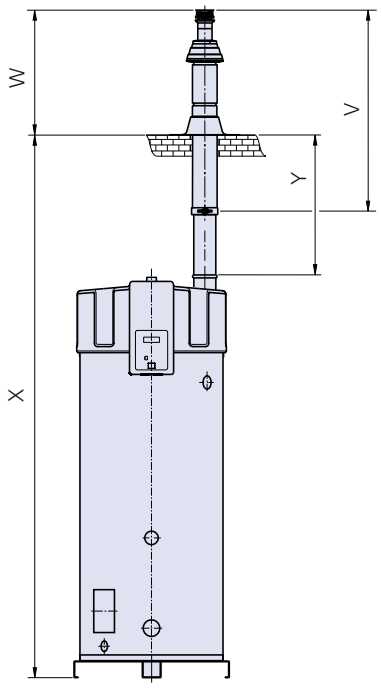
Dorchester DR-FC Evo

Minimum Space Requirements

Wall Duct



Roof Duct



Minimum Space for Wall Duct

Model	Dimensions / mm					
	V	W	X	X*	Y	Y*
DR-FC Evo 25	550	790	1535	1985	1480	1030
DR-FC Evo 30	550	790	2075	2525	1480	1030
DR-FC Evo 45	550	790	2075	2525	1480	1030
DR-FC Evo 60	550	790	2075	2525	1480	1030
DR-FC Evo 80	640	940	2230	2680	1620	1170
DR-FC Evo 95	640	940	2230	2680	1620	1170
DR-FC Evo 120	640	940	2230	2680	1620	1170

** Distance without concentric pipe between bend and wall duct.*

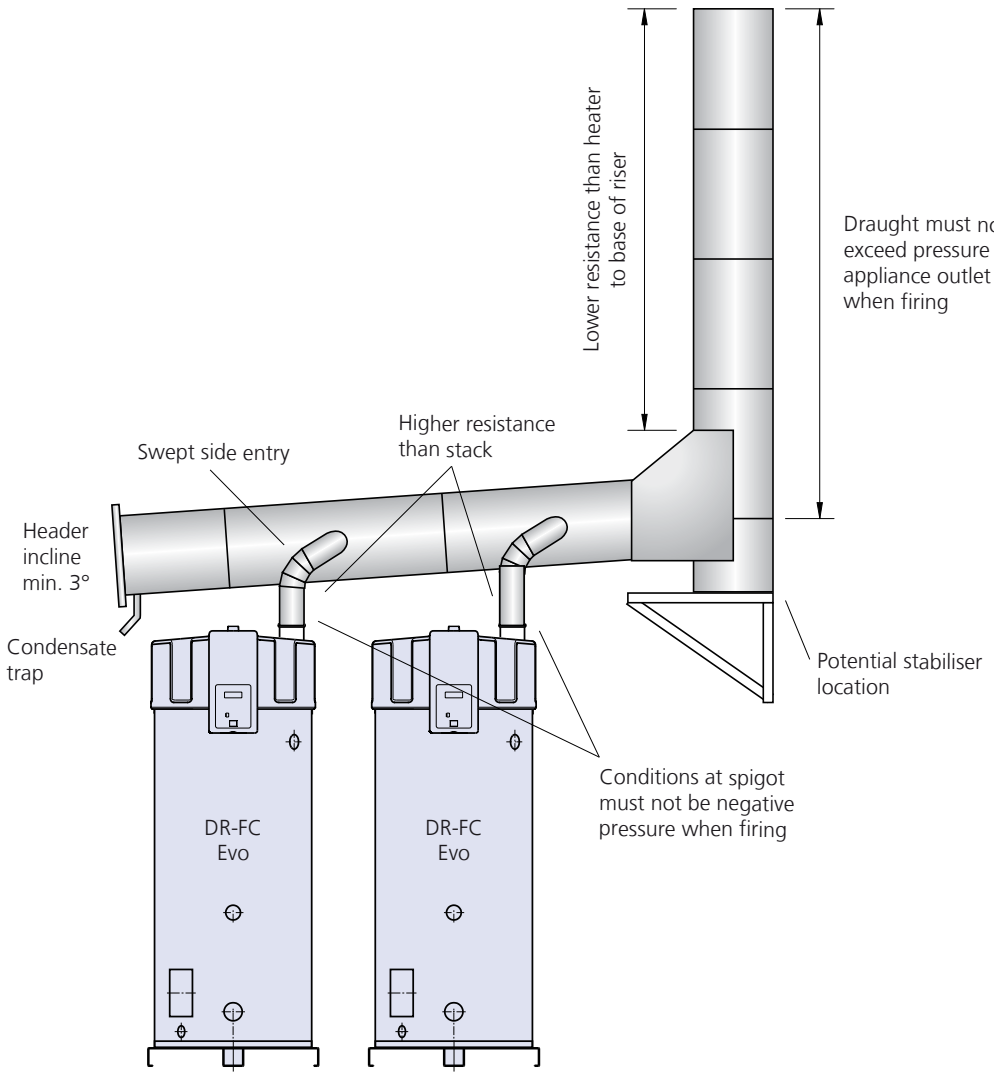
Minimum Space for Roof Duct

Model	Dimensions / mm					
	V	W	X	X**	Y	Y**
DR-FC Evo 25	1500	1035	2965	2015	1415	465
DR-FC Evo 30	1500	1035	3325	2375	1415	465
DR-FC Evo 45	1500	1035	3325	2375	1415	465
DR-FC Evo 60	1500	1035	3325	2375	1415	465
DR-FC Evo 80	1730	1120	3620	2670	1560	610
DR-FC Evo 95	1730	1120	3620	2670	1560	610
DR-FC Evo 120	1730	1120	3620	2670	1560	610

*** Distance without concentric pipe between appliance and roof duct.*

Flue Design for Combined Systems

Dorchester DR-FC Evo
Multiple Water Heaters - Open Flue System, Type B23


Lower resistance than heater to base of riser
Draught must not exceed pressure at appliance outlet when firing
Higher resistance than stack
Swept side entry
Header incline min. 3°
Condensate trap
Potential stabiliser location
Conditions at spigot must not be negative pressure when firing
DR-FC Evo
DR-FC Evo

Multiple Water Heaters—Same Appliance Types

Dorchester DR-FC Evo water heaters may be used with natural draught flue systems, and should be designed in accordance with current regulations.

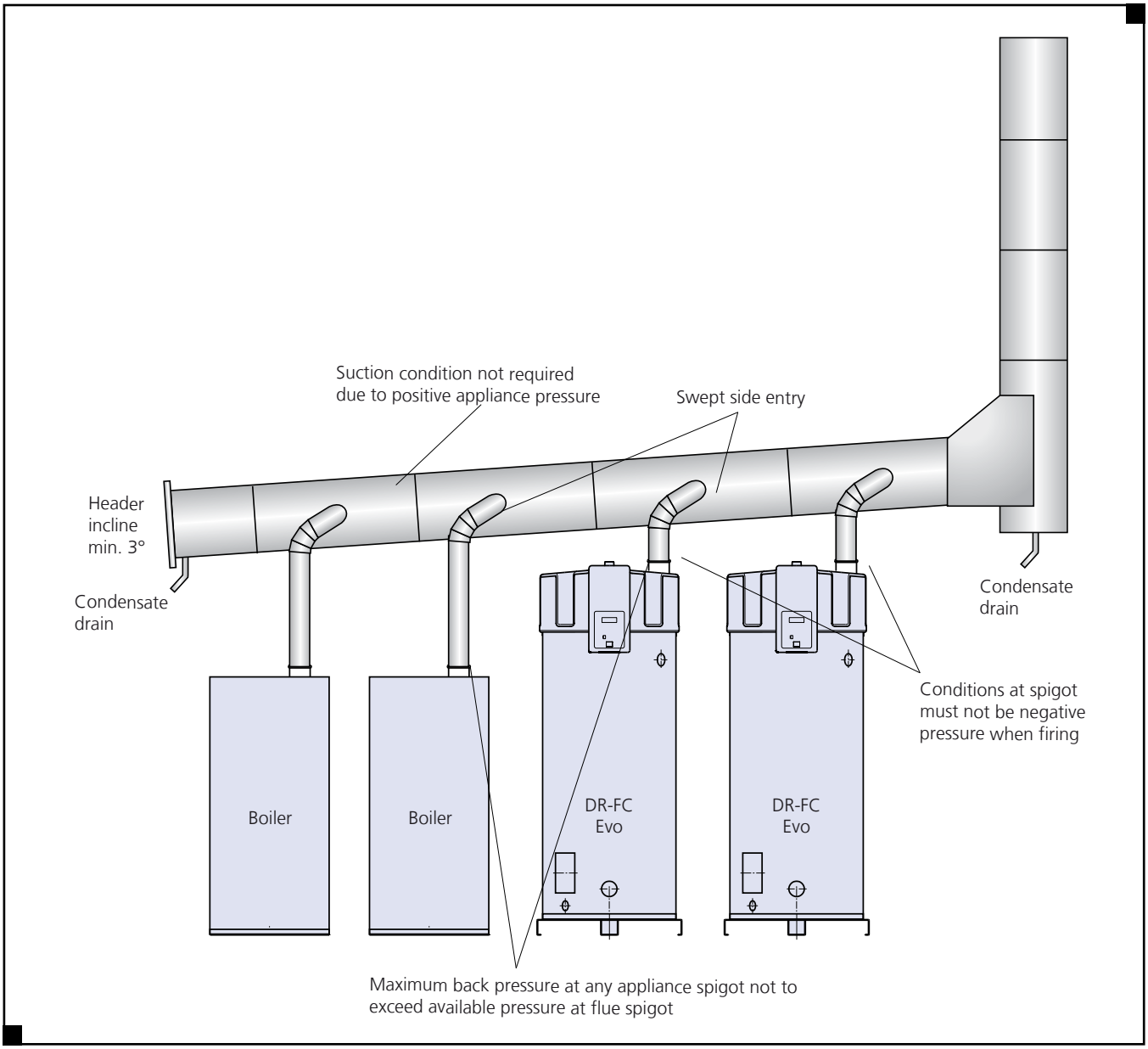
These water heaters have a pressurised flue outlet, enabling a flue installation to be designed using smaller diameter components than with traditional atmospheric water heaters.

Multiple Dorchester DR-FC Evo water heaters may be installed using a common flue header. The use of swept connections from appliances into a common flue is recommended to assist the flow of gases into the common flue in the intended direction of flow.

The combustion circuit within Dorchester DR-FC Evo water heaters is not equipped with a back flow prevention device, it is therefore imperative that flue systems for multiple Dorchester DR-FC Evo water heaters are designed to prevent the possibility of flue gases from other heaters spilling through non firing water heaters.

Flue Design for Combined Systems

Dorchester DR-FC Evo
Multiple Water Heaters - Open Flue System, Type B23



Multiple Water Heaters—Different Appliance Types

Dorchester DR-FC Evo water heaters may be installed with other similar pre-mix pressurised flue outlet appliances, such as heating boilers, in a common flue system with natural draught flue systems. Flue systems should be designed in accordance with current regulations.

For advice on flue system design, please contact our technical support team: Telephone 01202 662500.

Alternatively for a full flue system design and installation service, contact our flue partner: Telephone 0845 450 2867.

Customer Service Centre

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